Opposing Views Attachment #4

Roads Damage the Proper Ecological Functioning of the Natural Resources in a Forest

Note to the Responsible Official who reads these opposing views: There are negative effects caused by nearly all actions … this includes forest road construction. The public deserves to consider projects proposed to occur on their land with the knowledge of the pros and cons of the project. None of the sources for the opposing views is specific to this project. Information contained in books and/or scientific prediction literature are not specific to individual projects. They describe cause and effects relationships that exist when certain criteria are met.

Indeed, the literature in the References section of the draft NEPA document is not specific to the project yet its used to help design this project.

The opposing views presented below are not always right or wrong. When responding to opposing views that the Responsible Official believes are "reasonable" please discuss them in the context of this project.

Once again, this gives the public complete project understanding.

Road Construction Opposing View #1 - "Fragmentation has been considered as one of the most major factors that lead to the decline of many wildlife species (Brittingham and Temple 1983, Yahner 1988, Winslow et al. 2000) because fragmentation tends to decrease population productivity (Robinson et al. 1995). Therefore, Meffe states that "fragmentation has become a major subject of research and debate in conservation biology" (Meffe et al. 1997, p. 272). Forest fragmentation usually occurs when large and continuous forests are divided into smaller patches as a result of road establishment, clearing for agriculture, and human development (Robinson et al. 1995, Meffe et al. 1997)." (Pg. 1)

"Generally, habitat fragmentation is an ecological process in which a large patch of habitat is divided into smaller patches of habitats. Usually, this process is caused by human activities (roads, agriculture, and logging). It also reduces the value of the landscape as habitat for many species (plants and animals). Fragmentation alters natural habitat in many ways, including reduction of patches' sizes, increment of distances between similar patches, and increment of edges and predation (Brittingham and Temple 1983, Robinson et al. 1995)." (Pp. 2 and 3)

Al-jabber, Jabber M. 2003
"**Habitat Fragmentation: Effects and Implications**"
http://faculty.ksu.edu.sa/a/Documents/Habitat%20Fragmentation%20Effects%20and%20Implication.pdf

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Road Construction Opposing View #2 - "Debris slides over a 20-year period were inventoried on 137,500 acres of forested land in the Klamath Mountains of southwest Oregon. Frequency during the study period was about one slide every 4.3 years on each 1,000 acres-an erosion rate of about 1/2 yd^3 per acre per year. Erosion rates on roads and landings were 100 times those on undisturbed areas, while erosion on harvested areas was seven times that of undisturbed areas. Three-quarters of the slides were found on slopes steeper than 70 percent and half were on the lower third of slopes."

"Soil erosion rates due to debris slides were many times higher on forests with roads, landings, and logging activity than on undisturbed forests."

Amaranthus, Mike P. Ph.D., Raymond M. Rice Ph.D., N. R. Barr and R. R. Ziemer Ph.D. **"Logging and forest roads related to increased debris slides in southwestern Oregon."**
Journal of Forestry Vol. 83, No. 4. 1985.
http://www.humboldt.edu/~rrz7001/pubs/Ziemer85.PDF

Road Construction Opposing View #3 - " 'Roads may have unavoidable effects on streams, no matter how well they are located, designed or maintained. The sediment contribution to streams from roads is often much greater than that from all other land management activities

combined, including log skidding and yarding.' *(Gibbons and Salo 1973)*. Research by *Megahan and Kidd* in 1972 found that roads built in areas with highly erosive soils can contribute up to 220 times as much sediment to streams as intact forests."

"**Applying Ecological Principles to Management of the U.S. National Forests**"
Issues in Ecology Number 6 Spring 2000
http://www.watertalk.org/wawa/ecosci.html

Road Construction Opposing View #4 - "Plot-level studies have demonstrated the ability of forest roads to intercept and route both subsurface and surface overland flow more efficiently to the stream network. Significant amount of subsurface throughflow can be intercepted by the road, as a function of the road cut depth and the current saturation deficit, and then redirected, concentrating the flow in particular areas below the road. Road drainage concentration increases the effective length of the channel network and strongly influences the distribution of erosional processes. The concept of wetness index has been used in the study as a surrogate for subsurface throughflow, and the effect of forest roads on subsurface throghflow rerouting has been assessed by evaluating the changes in terms of draining upslope areas. A threshold model for shallow slope instability has been used to analyse erosional impacts of drainage modifications. In the model, the occurrence of shallow landsliding is evaluated in terms of drainage areas, ground slope and soil properties (i.e., hydraulic conductivity, bulk density, and friction angle). The model has been used to generate hypotheses about the broader geomorphic effect of roads. Modelling results have been compared with available field data collected in north-eastern Italy."

Borga, M., F. Tonelli, G. Dalla Fontana and F. Cazorzi
"**Evaluating the Effects of Forest Roads on Shallow Landsliding**"
Geophysical Research Abstracts, Vol. 5, 13312, 2003
http://www.cosis.net/abstracts/EAE03/13312/EAE03-J-13312.pdf

Road Construction Opposing View #5 - “A large scale land use experiment has taken place over the last 40 years in the mountainous areas of the northwestern U.S. through timber harvesting. This land use change effects the hydrology of an area through two mechanisms:

- Clear-cut logging which causes changes in the dynamics of Rain-On-Snow (ROS) events due to changes in the accumulation and ablation of snow caused by vegetation effects on snow interception and melt; and

- Construction and maintenance of forest roads which channel intercepted subsurface flow and infiltration excess runoff to the stream network more quickly.”

Bowling, L.C., D. P. Lettenmaier, M. S. Wigmosta and W. A. Perkins
“**Predicting the Effects of Forest Roads on Streamflow using a Distributed Hydrological Model**”
from a poster presented at the fall meeting of the American Geophysica Union, San Francisco, CA, December 1996.
http://www.ce.washington.edu/~lxb/poster.html

Road Construction Opposing View #6 - "Many of the conclusions and assumptions contained in the Roads Report are based on analysis of the positive contributions of roads. Negative socio-economic effects of roads have been, in large part, glossed over. The general view expressed in the Roads Report is that overall, roads make a positive socio-economic contribution."

"The Socio-Economic Effects section has been constructed to overwhelmingly support the contention that the benefits of roads outweigh the costs. In order to arrive at such a conclusion, however, certain important economic costs and concepts have been omitted."

"A serious problem with the Roads Report is its lack of discussion concerning the economic costs arising from the negative ecological effects of roads. Despite overwhelming scientific data linking roads and sedimentation (Bennett 1991; Grayson et al. 1993; Lyon 1984; Megahan 1980; McCashion and Rice 1983; Wade 1998; Williams 1998), the socio-economic costs of mitigating the effects of this sedimentation receive no mention in the Roads Report. Such costs are central to and should be included in any socio-economic assessment of forest roads."

Road Construction Opposing View #7 - "The present road system constitutes a legacy of current and potential sources of damage to aquatic and riparian habitats, mostly through sedimentation, and to terrestrial habitats through fragmentation and increased access" (Amaranthus et all 1985)."

"The failure of the Report to properly address mitigation costs associated with the ecological effects is a serious problem that needs to be addressed in future drafts. Similarly, passive-use values need to be taken seriously and considered throughout the Roads Report. In order to rectify these problems, most of the Socio-Economic Effects subsections will have to be reworked. Failing to do so, the Roads Report will paint an incomplete picture of the costs and benefits associated with the Forest Service's road program."

Brister, Daniel. **"A Review and Comment on: *Forest Service Roads: A Synthesis of Scientific Information*, 2nd Draft, USDA Forest Service."** December 1998.
http://www.wildlandscpr.org/forest-service-roads-synthesis-scientific-information-socio-economic-impacts

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Road Construction Opposing View #8 - "Sediment input to freshwater is due to either the slower, large-scale process of soil erosion, or to rapid, localized “mass movements,” such as landslides. Forest practices can increase the rate at which both processes occur. Most sediment from forestry arises from landslides from roads and clearcuts on steep slopes, stream bank collapse after riparian harvesting, and soil erosion from logging roads and harvested areas. Roads, particularly those that are active for long periods of time, are likely the largest contributor of forestry-induced sediment (Furniss et al. 1991)."

"Sediment can increase even when roads comprise just 3% of a basin (Cederholm et al. 1981)."

"More than half the species present in the study area will likely be negatively impacted by sedimentation from logging roads."

"In areas made highly turbid (cloudy) from sedimentation, the foraging ability of adults and juveniles may be inhibited through decreased algal production and subsequent declines in insect abundance, or, for visual-feeding taxa dependent on good light, through their inability to find and capture food. Highly silted water may damage gill tissue and cause mortality or physiological stress of adults and juveniles."

Bunnell, Fred L. Ph.D., Kelly A. Squires and Isabelle Houde. 2004
"Evaluating effects of large-scale salvage logging for mountain pine beetle on terrestrial and aquatic vertebrates."
Mountain Pine Beetle Initiative Working Paper 1. Canadian Forest Service.
http://warehouse.pfc.forestry.ca/pfc/25154.pdf

Road Construction Opposing View #9 - "The road construction and right-of-way logging were immediately detrimental to most aquatic invertebrates in South Fork Caspar Creek"

"Salmonid populations decreased immediately after the road construction."

"Sustained logging and associated road construction over a period of many years do not afford either the stream or the 'fish population a chance to recover."

Burns, James W., **"Some Effects of Logging and Associated Road Construction on Northern California Streams."** *Transactions of the American Fisheries Society*, Volume 1, Number 1, January 1972.
http://www.fs.fed.us/psw/publications/4351/Burns72.pdf

Road Construction Opposing View #10 has been deleted.

Road Construction Opposing View #11 - "Forest roads apparently can serve as a partial filter to the movements of some amphibian species"

deMaynadier, Phillip G. and Malcolm L. Hunter, Jr. "**Road Effects on Amphibian Movements in a Forested Landscape**"
From *Natural Areas Journal* (2000)
Volume: 20, Issue: 1, Pages: 56-65
http://www.mendeley.com/research/road-effects-on-amphibian-movements-in-a-forested-landscape/

Road Construction Opposing View #12 - "Roads often cause serious ecological impacts. There are few more irreparable marks we can leave on the land than to build a road."

Dombeck, Mike Ph.D., US Forest Service Chief, 1997-2001
Remarks made to Forest Service employees and retirees
at the University of Montana. February 1998.
https://www.uwsp.edu/cnr/gem/Dombeck/MDSpeeches/CD%20COPY/Chief%20Mike%20Dombeck%27s%20Remarks%20to%20Forest%20Service%20Employees%20and%20.htm

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Road Construction Opposing View #13 - "Few marks on the land are more lasting than roads."

"The negative effects on the landscape of constructing new roads, deferring maintenance, and decommissioning old roads are well documented. Unwanted or non-native plant species can be transported on vehicles and clothing by users of roads, ultimately displacing native species. Roads may fragment and degrade habitat for wildlife species and eliminate travel corridors of other species. Poorly designed or maintained roads promote erosion and landslides, degrading riparian and wetland habitat through sedimentation and changes in streamflow and water temperature, with associated reductions in fish habitat and productivity. Also, roads allow people to travel into previously difficult or impossible to access areas, resulting in indirect impacts such as ground and habitat disturbance, increased pressure on wildlife species, increased litter, sanitation needs and vandalism, and increased frequency of human-caused fires."

EPA entry into the Federal Register: March 3, 2000 (Volume 65,
Number 43) Page 11675, **"National Forest System Road Management."**
http://www.epa.gov/fedrgstr/EPA-GENERAL/2000/March/Day-03/g5002.htm

Road Construction Opposing View #14 - “Fragmentation caused by roads is of special interest because the effects of roads extend tens to hundreds of yards from the roads themselves, altering habitats and water drainage patterns, disrupting wildlife movement, introducing exotic plant species, and increasing noise levels. The land development that follows roads out into rural areas usually leads to more roads, an expansion process that only ends at natural or legislated barriers.”

“**Forest Fragmentation and Roads**”
Eastern Forest Environmental Threat Assessment Center
U.S. Forest Service - Southern Research Station
http://www.forestthreats.org/publications/su-srs-018/fragmentation

Road Construction Opposing View #15 - “A huge road network with vehicles ramifies across the land, representing a surprising frontier of ecology. Species-rich roadsides are conduits for few species. Roadkills are a premier mortality source, yet except for local spots, rates rarely limit population size. Road avoidance, especially due to traffic noise, has a greater ecological impact. The still-more-important barrier effect subdivides populations, with demographic and probably genetic consequences. Road networks crossing landscapes cause local hydrologic and erosion effects, whereas stream networks and distant valleys receive major peak-flow and sediment impacts. Chemical effects mainly occur near roads. Road networks interrupt horizontal ecological flows, alter landscape spatial pattern, and therefore inhibit important interior species. Thus, road density and network structure are informative landscape ecology assays. Australia has huge road-reserve networks of native vegetation, whereas the Dutch have tunnels and overpasses perforating road barriers to enhance

ecological flows. Based on road-effect zones, an estimated 15–20% of the United States is ecologically impacted by roads."

Forman, Richard T. and Lauren E. Alexander "**Roads and their Major Ecological Effects**" *Annual Review of Ecology and Systematics*, Vol. 29: 207-231, November 1998
http://arjournals.annualreviews.org/doi/abs/10.1146/annurev.ecolsys.29.1.207?cookieSet=1&journalCode=ecolsys.1

Road Construction Opposing View #16 - "Questions to consider: Roads dramatically alter forest ecosystems

1. Does the management prescription account for the ecological effects of the road construction and maintenance activities associated with carrying out such activities?

2. Have alternatives to road building been considered? How does the plan attempt to address the effects of roads?" (page 37)

Franklin, Jerry Ph.D., David Perry Ph.D., Reed Noss Ph.D., David Montgomery Ph.D. and Christopher Frissell Ph.D. 2000. **"Simplified Forest Management to Achieve Watershed and Forest Health: A Critique."**
A National Wildlife Federation publication sponsored by the Bullitt Foundation
http://www.coastrange.org/documents/forestreport.pdf

Road Construction Opposing View #17 - "The authors warned that cutting roads into current roadless areas could bring much more harm to wildlife, soil and fisheries than the beetle-killed trees pose to the forest."

Frey, David "**Logging Won't Halt Beetles, Fire, Report Says**"

NewWest.net, 3-03-10
http://www.newwest.net/topic/article/logging_wont_halt_beetles_fire_report_says/C41/L41/

Road Construction Opposing View #18 - "Rarely can roads be designed and built that have no negative impacts on streams. Roads modify natural drainage patterns and can increase hillslope erosion and downstream sedimentation. Sediments from road failures at stream crossings are deposited directly into stream habitats and can have both on-site and off-site effects. These include alterations of the channel pattern or morphology, increased bank erosion and changes in channel width, substrate composition, and stability of slopes adjacent to the channels."

"All of these changes result in important biological consequences that can affect the entire stream ecosystem. One specific example involves anadromous salmonids, such as salmon and steelhead, that have complex life histories and require suitable stream habitat to support both juvenile and adult life stages."

"A healthy fishery requires access to suitable habitat that provides food, shelter, spawning gravel, suitable water quality, and access for upstream and downstream migration. Road-stream crossing failures have direct impacts on all of these components."

Furniss, Michael J., Michael Love Ph.D. and Sam A. Flanagan
"Diversion Potential at Road-Stream Crossings." USDA Forest Service. *9777 1814—SDTDC.* December 1997.
http://www.stream.fs.fed.us/water-road/w-r-pdf/diversionpntl.pdf

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Road Construction Opposing View #19 - “Barry Noon, a professor of wildlife ecology at Colorado State University, noted that scientific research has consistently shown the adverse effects of roads on hydrologic processes and fish and wildlife populations.

“ “One of the key things to recognize is the effects of the roads extend far beyond their immediate footprint,” Noon said. For example, “in terms of hydrology, the roads are leading to faster runoff of water, often with great increases in sedimentation, particularly following storm events, and roads in watersheds often lead to increases in the intensity of floods.” “

These changes degrade fish habitat because of the increased sedimentation that leads to decreases in water quality, Noon said. And roads fragment wildlife habitat and create areas that animals avoid, often as result of increased hunting, he said.”

Gable, Eryn “Battling beetles may not reduce fore risks – report”
Land Letter, March 4, 2010
http://www.xerces.org/2010/03/04/battling-beetles-may-not-reduce-fire-risks-report/

Road Construction Opposing View #20 - "Roads and skid trails have been identified as a major contributor to increased turbidity of water draining logging areas resulting in increases from 4 to 93 parts per million (Hoover, 1952). Forest roads have been found to have erosion rates from one to three orders of magnitude greater than similar undisturbed areas (Megahan, 1974) and perhaps account for as much as 90 percent of all forest erosion (Megahan, 1972). Forest roads can also cause soil erosion and stream sedimentation, which adversely impact on the nation’s water quality (Authur et al., 1998).

Grace, Johnny M. III Ph.D. 2003. **"Minimizing the impacts of the forest road system."** In: Proceedings of the conference 34 international erosion control association; ISSN 1092-2806. [Place of publication unknown]: International Erosion Control Association: 301-310.
http://www.srs.fs.usda.gov/pubs/ja/ja_grace011.pdf

Road Construction Opposing View #21 - "Roads have well-documented, short- and long-term effects on the environment that have become highly controversial, because of the value society now places on unroaded wildlands and because of wilderness conflicts with resource extraction."

"(Road) consequences include adverse effects on hydrology and geomorphic features (such as debris slides and sedimentation), habitat fragmentation, predation, road kill, invasion by exotic species, dispersal of pathogens, degraded water quality and chemical contamination, degraded aquatic habitat, use conflicts, destructive human actions (for example, trash dumping, illegal hunting, fires), lost solitude, depressed local economies, loss of soil productivity, and decline in biodiversity."

Gucinski, Hermann Ph.D., Michael J. Furniss, Robert R. Ziemer Ph.D.
and Martha H. Brookes, Editors. 2001. **"Forest Roads: A Synthesis of Scientific Information."**
USDA Forest Service, General Technical Report *PNW-GTR-509*.
http://www.fs.fed.us/pnw/pubs/gtr509.pdf

Road Construction Opposing View #22 - "Fires in the roaded areas are more intense, due to drier conditions, wind zones on the foothill/valley interface, high surface-fuel loading, and dense stands."

Hann, W.J. et al. 1997
Landscape dynamics of the Basin. Pp. 337-1,055
in: Quigley, T.M. and S.J. Arbelbide (eds.)
An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins: Volume II. USDA Forest Service, PNW-GTR-405

http://www.fs.fed.us/pnw/pubs/gtr405/pnw_gtr405aa.pdf

Road Construction Opposing View #23 - "Many forested landscapes are fragmented by roads, but our understanding of the effects of these roads on the function and diversity of the surrounding forest is in its infancy. I investigated the effect of roads in otherwise continuous forests on the macroinvertebrate fauna of the soil. I took soil samples along transects leading away from the edges of unpaved roads in the Cherokee National Forest in the Southern Appalachian mountains of the United States. Roads significantly depressed both the abundance and the richness of the macroinvertebrate soil fauna. Roads also significantly reduced the depth of the leaf-litter layer. These effects persisted up to 100 m into the forest. Wider roads and roads with more open canopies tended to produce steeper declines in abundance, richness, and leaf-litter depth, but these effects were significant only for canopy cover and litter depth. The macroinvertebrate fauna of the leaf litter plays a pivotal role in the ability of the soil to process energy and nutrients. These macroinvertebrates also provide prey for vertebrate species such as salamanders and ground-foraging birds. The effect of roads on the surrounding forest is compounded by the sprawling nature of the road system in this and many other forests. My data suggest that even relatively narrow roads through forests can produce marked edge effects that may have negative consequences for the function and diversity of the forest ecosystem."

Haskell, David G. Ph.D. 1999 "**Effects of Forest Roads on Macroinvertebrate Soil Fauna of the Southern Appalachian Mountains**"
http://www.jstor.org/stable/2641904

Road Construction Opposing View #24 - “Roads remove habitat, alter adjacent areas, and interrupt and redirect ecological flows. They subdivide wildlife populations, foster invasive species spread, change the hydrologic network, and increase human use of adjacent areas. At broad scales, these impacts cumulate and define landscape patterns.”

Hawbaker, Todd J. Ph.D., Volker C. Radeloff Ph.D.,
Murray K. Clayton Ph.D., Roger B. Hammer Ph.D.,
and Charlotte E. Gonzalez-Abraham Ph.D.
“**Road Development, Housing Growth, and Landscape Fragmentation In Northern Wisconsin: 1937–1999**”
Ecological Applications: Vol. 16, No. 3, pp. 1222-1237.
http://www.esajournals.org/doi/abs/10.1890/1051-0761%282006%29016%5B1222%3ARDHGAL%5D2.0.CO%3B2?journalCode=ecap

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Road Construction Opposing View #25 - “Last winter was unusually wet in the Pacific Northwest. The result was landslides all over caused by logging roads; five people died, spawning streams were ruined, water supplies were contaminated and the flooding was tremendously aggravated. According to David Bayles, conservation director of the Pacific Rivers Council, aerial surveys documented more than 650 landslides in February in Washington and Oregon alone. The stupidest and most dangerous practice is allowing logging roads on steep slopes — that's really asking for it.

You may ask yourself why the taxpayers are expected to pony up to build roads for profitable logging companies. Build roads for the timber companies in order to stimulate the U.S. logging, paper and building industries. There's just one problem. A lot of U.S. logs get shipped overseas, mostly to Japan. We're actually subsidizing Japanese companies while doing terrible damage to our environment and not helping the U.S. job scene much except when it comes to cutting

Start with the assumption that the U.S. Forest Service a component of the Department of Agriculture, is simply an auxiliary branch of the timber

industry and you'll pretty much have the picture of what's going on. Last winter, the Forest Service refused a bid at a timber auction from an environmentalist who wanted to save, not harvest, a stand of evergreens in the Okanogan National Forest in Washington. Instead, the Forest Service accepted a bid of $15,000 from a logging company that cut 3.5 million board-feet of lumber in that stand. Try to find a price like that at Home Depot."

Ivins, Molly
Creators Syndicate, August 3 1997 08 03
http://www.creators.com/opinion/molly-ivins/molly-ivins-august-3-1997-08-03.html

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Road Construction Opposing View #26 - "Although disturbance patches are created by peak flow and debris flow disturbances in mountain landscapes without roads, roads can alter the landscape distributions of the starting and stopping points of debris flows, and they can alter the balance between the intensity of flood peaks and the stream network's resistance to change."

Jones, Julia A. Ph.D., Frederick J. Swanson Ph.D.
Beverley C. Wemple Ph.D., and Kai U. Snyder. **"Effects of roads on hydrology, geomorphology, and disturbance patches in stream networks."** *Conservation Biology* 14, No. 1. 2000.
http://www.jstor.org/stable/2641906

Road Construction Opposing View #27 - "In the Pacific Northwest, the two main processes that contribute to sediment production are mass failure and surface erosion from forest roads (Fredriksen 1970, Reid and Dunne 1984). In the Clearwater River basin in the State of Washington, as much

as 40 percent of the sediment produced in the watershed was attributed to logging roads (Reid 1980)."

Kahklen, Keith. **"A Method for Measuring Sediment Production from Forest Roads."** Pacific Northwest Research Station, USDA Forest Service. Research note *PNW-RN-529*, April 2001. http://www.fs.fed.us/pnw/pubs/rn529.pdf

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Road Construction Opposing View #28 - "It is indisputable that roads are one of the greatest threats to the ecological integrity of forested systems and associated river, wetland, lake, and coastal ecosystems. Yet, the USFS has failed to adopt a policy that mandates reversing the worst ecological effects of roads, or that precludes incursion of roads into roadless areas. Despite widespread recognition of these facts, the USFS diverts staff and money to extraordinarily costly salvage logging projects at the expense of reducing the extent of the road network or undertaking needed fine-fuels reductions in unburned forests."

Karr, James R. Ph.D., Christopher A. Frissell Ph.D., Jonathan J. Rhodes, David L. Perry Ph.D. and G. Wayne Minshall Ph.D. **Excerpt from a letter to the Subcommittee on Forests & Forest Health U.S. House of Representatives**. 3 July, 2002. http://www.nativeforest.org/campaigns/wildfire_info_center/letter_from_beschta.htm

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Road Construction Opposing View #29 - "Forest fragmentation, as scientists call the intentional felling of woodland, is actually two processes. In populated areas such as the Atlantic seaboard, it means reduction in the size of forest tracts, usually due to suburbanization and development. In less inhabited areas--northern New England, for example--forest

fragmentation refers to isolation of one patch of forest from another by logging, or by the building of roads or power lines."

Lawren, Bill 1992 "Singing the Blues for Songbirds: Bird lovers lament as experts ponder the decline of dozens of forest species" *National Wildlife*
http://www.nwf.org/News-and-Magazines/National-Wildlife/Birds/Archives/1992/Singing-the-Blues-for-Songbirds.aspx

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Road Construction Opposing View #30 - "The compaction of forest road soils is known to reduce aeration, porosity, infiltration rates, water movement, and biological activity in soils. Research indicates that soil bulk density, organic matter, moisture, and litter depths are much lower on roads than on nearby forest lands. Macropores, which provide soil drainage and infiltration, have been shown to significantly decrease in size as a result of road construction and use. Reduced infiltration and increased compaction promote soil erosion, especially during the seasonal southwestern monsoon rains (Elseroad 2001)."

"Physical disturbances caused by road construction and vehicle use create ideal conditions for colonization by invasive exotic plant species. The use of roads by vehicles, machinery, or humans often aids the spread of exotic plant seeds. Once established, they can have long-term impacts on surrounding ecosystems and can be difficult to remove."

"Roads are known to cause habitat fragmentation. Many create ecological 'edges' with different plant species, light levels, and hiding cover, all of which may alter animal survival, reproductive success, and movement patterns. The introduction of exotic plants can disrupt the availability of native vegetation used by wildlife for food and shelter (Trombulak and Frissell 1999)."

"Forest roads often develop a water-repellent soil layer caused by lack of vegetative cover and changes in soil composition. This can substantially influence how runoff is processed. Erosion, the formation of water

channels beside the road, and increased sediment loads in nearby streams are common results of this process (Baker 2003)."

"Because they provide easier access to many forest tracts, forest roads often allow more human-caused fires to be ignited."

Lowe, Kimberly Ph.D.,**"Restoring Forest Roads."**
A Northern Arizona University Ecological Restoration Institute publication
Working Paper 12. June, 2005.
http://www.eri.nau.edu/en/information-for-practitioners/restoring-forest-roads

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Road Construction Opposing View #31 - "Almost everywhere people live and work they build and use unimproved roads, and wherever the roads go, a range of environmental issues follows."

"Among the environmental effects of unimproved roads, those on water quality and aquatic ecology are some of the most critical. Increased chronic sedimentation, in particular, can dramatically change the food web in affected streams and lakes."

"The nearly impervious nature of road surfaces (or treads) makes them unique within forested environments and causes runoff generation even in mild rainfall events, leading to chronic fine sediment contributions."

"If we look at the issue of what we need to learn or the research priorities for forest road hydrology, I would argue that the areas of cutslope hydrology and effectiveness of restoration efforts are perhaps most critical."

"At a few sites in the mountains of Idaho and Oregon a substantial portion of the road runoff (80–95%) came from subsurface flow intercepted by the cutslope (Burroughs *et al*., 1972; Megahan, 1972; Wemple, 1998)."

Luce, Charles H. Ph.D., 2002. **"Hydrological processes and pathways affected by forest roads: what do we still need to learn?"**
Hydrologic Processes: 16, 2901–2904.

http://www.fs.fed.us/rm/boise/teams/soils/Publications/Luce%202002%20HP.pdf

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Road Construction Opposing View #32 - "Roads in the watershed contribute to sediment production by concentrating runoff, thereby increasing sediment load to the stream network. Most unimproved (dirt) roads connect either directly or indirectly with streams and, therefore, act as extensions of stream networks by effectively increasing watershed drainage density and subsequently sediment loads to streams. In the South Fork subwatershed of Squaw Creek, road connectivity has resulted in an increase in effective drainage density of approximately 250%. Throughout the Squaw Creek watershed, it is estimated that dirt roads potentially contribute as much as 7,793 metric tons/year to the watershed sediment budget."

Maholland, Becky and Thomas F. Bullard Ph.D., **"Sediment-Related Road Effects on Stream Channel Networks in an Eastern Sierra Nevada Watershed."** *Journal of the Nevada Water Resources Association*, Volume 2, Number 2, Fall 2005.
http://www.nvwra.org/docs/journal/vol_2_no_2/NWRAjournal_fall2005_article4.pdf

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Road Construction Opposing View #33 - "One of the greatest impacts of roads and (especially motorized) trails is their effect on the hydrology of natural landscapes, including the flow of surface and ground water and nutrients. These hydrologic effects are responsible for changes to geomorphic processes and sediment loads in roaded areas (Luce and Wemple 2001)." (pg. 12)

Malecki, Ron W. "**A New Way to Look at Forest Roads: the Road Hydrologic Impact Rating System (RHIR)**"

The Road-RIPorter, Autumn Equinox, 2006
http://www.wildlandscpr.org/files/uploads/RIPorter/rr_v11-3.pdf

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Road Construction Opposing View #34 - "A study was made on 344 miles of logging roads in northwestern California to assess sources of erosion and the extent to which road-related erosion is avoidable. At most, about 24 percent of the erosion measured on the logging roads could have been prevented by conventional engineering methods. The remaining 76 percent was caused by site conditions and choice of alignment. On 30,300 acres of commercial timberland, an estimated 40 percent of the total erosion associated with management of the area was found to have been derived from the road system."

McCashion, J. D. and R. M. Rice Ph.D. 1983. **"Erosion on logging roads in northwestern California: How much is avoidable?"** *Journal of Forestry* 8(1): 23-26.
http://www.fs.fed.us/psw/rsl/projects/water/McCashion.pdf

Road Construction Opposing View #35 - "Research has shown that roads can have adverse impacts on the water quality on the forest landscape (Authur et al. 1998; Binkley and Brown 1993; Megahan et al. 1991). The forest road system has been identified by previous research as the major source of soil erosion on forestlands (Anderson et. al 1976; Patric 1976; Swift 1984; Van Lear et al. 1997). Furthermore, roads are cited as the dominant source of sediment that reaches stream channels (Packer 1967; Trimble and Sartz 1957; Haupt 1959)."

McFero III, Grace, J. **"Sediment Plume Development from Forest Roads: How are they related to Filter Strip Recommendations?"**

An ASAE/CSAE Meeting Presentation, Paper Number: 045015, August 1-4, 2004.
http://www.srs.fs.usda.gov/pubs/ja/ja_grace017.pdf

Road Construction Opposing View #36 - "Overall, roads had a greater impact on landscape structure than logging in our study area. Indeed, the 3-fold increase in road density between 1950–1993 accounted for most of the changes in landscape configuration associated with mean patch size, edge density, and core area."

McGarigal, Kevin Ph.D., William H. Romme Ph.D.
Michele Crist Ph.D.and Ed Roworth Ph.D. "**Cumulative effects of roads and logging on landscape structure in the San Juan Mountains, Colorado (USA)**"
Landscape Ecology, Volume 16, Number 4 / May, 2001
http://www.springerlink.com/content/w12557624742tv77/

Road Construction Opposing View #37 - "Road construction in remote areas appears to be the major long term impact of resource extraction industries and the most significant problem facing grizzly bears in most locations. Open roads are an influence in all 5 ways that people affect bears. Vehicles on roads can harass bears, displace them from quality habitats, and cause reduced bear use of altered habitats, such as cutting units. Bears that are displaced from roads may cause social disruption in areas away from roads. Finally, roads permit access for many people and some of these will shoot bears." (Pg. 62)

McLellan, Bruce N. "**Relationships between Human Industrial Activity and Grizzly Bears**"
Bears: Their Biology and Management, Vol. 8
International Conference on Bear Research and Management

February 1989 (1990), pp. 57-64
http://www.bearbiology.com/fileadmin/tpl/Downloads/URSUS/Vol_8/McClellan_8.pdf

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Road Construction Opposing View #38 - "Erosion from forest roads can be a large source of sediment in watersheds managed for timber production."

Megahan, Walter F. Ph.D. "**Predicting Road Surface Erosion from Forest Roads in Washington State**"
from a presentation presented at the 2003 Geological Society of America meeting.
http://gsa.confex.com/gsa/2003AM/finalprogram/abstract_67686.htm

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Road Construction Opposing View #39 - "Today, addressing the adverse impacts of forest roads is consistently identified as one of the highest watershed restoration priorities in U.S. forests—in many forested watersheds in the western United States there is a greater road density than stream density. It is simply irrational to spend millions of dollars subsidizing further forest road construction when we are simultaneously spending millions of dollars to offset detrimental effects associated with similar actions in the past."

Montgomery, David Ph.D., Statement at a Press Conference with Senator Robert Torricelli
about S. 977 and HR 1376), the Act to Save America's Forests
April 28, 1998, U.S. Capitol
http://www.saveamericasforests.org/news/ScientistsStatement.htm

Road Construction Opposing View #40 - “Nothing is worse for sensitive wildlife than a road. Over the last few decades, studies in a variety of terrestrial and aquatic ecosystems have demonstrated that many of the most pervasive threats to biological diversity - habitat destruction and fragmentation, edge effects, exotic species invasions, pollution, and overhunting - are aggravated by roads. Roads have been implicated as mortality sinks for animals ranging from snakes to wolves; as displacement factors affecting animal distribution and movement patterns; as population fragmenting factors; as sources of sediments that clog streams and destroy fisheries; as sources of deleterious edge effects; and as access corridors that encourage development, logging and poaching of rare plants and animals.”

"Most public agencies disregard the ecological impacts of roads, and attempt to justify timber roads as benefiting recreation and wildlife management. Even when a land manager recognizes the desirability of closing roads, he or she usually contends that such closures would be unacceptable to the public."

“The Forest Service and other public agencies will claim that road closures, revegetation, and other restorative measures are too expensive to be implemented on a broad scale. But much of the approximately $400 million of taxpayers' money squandered annually by the Forest Service on below-cost timber sales goes to road-building. Road maintenance is also expensive. Virtually all of this money could be channeled into road closures and associated habitat restoration. This work would be labor-intensive, and providing income to the many laid off loggers, timber sale planners, and road engineers -- for noble jobs, rather than jobs of destruction!”

Noss, Reed F., Ph.D. 1995. “**The Ecological Effects of Roads or the Road to Destruction**” *Wildlands CPR*
http://www.wildlandscpr.org/ecological-effects-roads

Road Construction Opposing View #41 - "Numerous studies have reported lower densities of breeding Ovenbirds (*Seiurus aurocapillus*) adjacent to forest edges. However, none of these studies has considered habitat use and reproductive success to address mechanisms underlying the observed pattern, and most were conducted in fragmented landscapes and ignored juxtapositions of forest with narrow openings such as roads. We studied the influence of forest roads on Ovenbird density in an extensively forested region of Vermont, evaluating habitat use and reproductive success relative to mechanisms proposed to explain the density-edge relationship. Territory densities on seven study plots were 40% lower within edge areas (0 to 150 m from unpaved roads) than within interior areas (150 to 300 m from roads). We simulated the distribution of Ovenbird territories and concluded that passive displacement, where birds perceive habitat interfaces as boundaries and limit their territories entirely to forest habitat, did not account for the observed density-edge pattern. Territory size was inversely related to distance from roads, providing an alternative explanation for reduced densities near edges and suggesting that habitat quality was higher away from roads. Pairing success was lower within edge areas than within interior zones, but the difference was not statistically significant. The proportion of males that produced fledglings did not differ between edge and interior areas. We conclude that habitat quality for Ovenbirds may be lower within 150 m of unpaved roads in extensive forested landscapes, affecting territory density and possibly reproductive success."

Ortega, Yvette K.; Capen, David E. 1999. "**Effects of forest roads on habitat quality for Ovenbirds in a forested landscape"** *Auk*. 116(4): 937-946.
http://www.fs.fed.us/rm/pubs_other/rmrs_1999_ortega_y001.html

Road Construction Opposing View #42 - “Increasingly, previously extensive, continuous tracts of forest are being reduced to widely dispersed patches of remnant forest vegetation by logging and road-building, but few measures of the effects of roads on forest fragmentation are available. Fragmentation affects animal populations in a variety of ways, including decreased species diversity and lower densities of some animal species in the resulting smaller patches. This study seeks to quantify the effects of roads and logging activities on forest habitat.”

“Roads precipitate fragmentation by dissecting previously large patches into smaller ones, and in so doing they create edge habitat in patches along both sides of the road, potentially at the expense of interior habitat. As the density of roads in landscapes increases, these effects increase as well. McGurk and Fong (1995) considered the additive effects of clearcuts and roads, but did not measure the amount of associated edge habitat. Thus a more direct measurement of the impacts of roads on landscapes is needed.”

Reed, R.A., Johnson-Barnard, J., and Baker, W.A. 1996. "**Contribution of Roads to Forest Fragmentation in the Rocky Mountains**." *Conservation Biology* 10: 1098-1106.
http://cpluhna.nau.edu/Research/contribution_of_roads_to_forest_.htm

Road Construction Opposing View #43 - “Erosion on roads is an important source of fine-grained sediment in streams draining logged basins of the Pacific Northwest. Runoff rates and sediment concentrations from 10 road segments subject to a variety of traffic levels were monitored to produce sediment rating curves and unit hydrographs for different use

levels and types of surfaces. These relationships are combined with a continuous rainfall record to calculate mean annual sediment yields from road segments of each use level. A heavily used road segment in the field area contributes 130 times as much sediment as an abandoned road. A paved road segment, along which cut slopes and ditches are the only sources of sediment, yields less than 1% as much sediment as a heavily used road with a gravel surface."

Reid, L. M. Ph.D. and T. Dunne (1984), "**Sediment Production from Forest Road Surfaces**," *Water Resour. Res.*, 20(11), 1753–1761. http://www.agu.org/pubs/crossref/1984/WR020i011p01753.shtml

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Road Construction Opposing View #44 - "Roads are associated with high sediment inputs and altered hydrology, both of which can strongly influence downstream channel habitats. Roads are also important as a source of indirect human impacts and as an agent of vegetation change and wildlife disturbance."

"Any ground disturbance increases the potential for erosion and hydrologic change, and roads are a major source of ground disturbance in wildlands. Compacted road surfaces generate overland flow, and much of this flow often enters the channel system, locally increasing peak flows. Localized peak flows are also increased where roads divert flow from one swale into another, and where roadcuts intercept subsurface flows."

"Overland flow from the road surface is a very effective transport medium for the abundant fine sediments that usually are generated on road surfaces. Road drainage also can excavate gullies and cause landslides downslope in swales. Cut and fill slopes are often susceptible to landsliding, and road-related landsliding is the most visible forestry-related erosional impact in many areas."

Reid, Leslie M. Ph.D., Robert R. Ziemer Ph.D., and Michael J. Furniss 1994. **"What do we know about Roads?"** USDA Forest Service. http://www.fs.fed.us/psw/publications/reid/4Roads.htm

Road Construction Opposing View #45 - "Disturbances from roadbuilding and logging changed the sediment/discharge relationship of the South Fork from one which was supply dependent to one which was stream power dependent, resulting in substantial increases in suspended sediment discharges."

"Road construction and logging appear to have resulted in increases in average turbidity levels (as inferred from suspended sediment increases) above those permitted by Regional Water Quality Regulations."

Rice, Raymond M. Ph.D., Forest B. Tilley and Patricia A. Datzman. 1979. **"Watershed's Response to Logging and Roads: South Fork of Caspar Creek, California, 1967-1976."** USDA Forest Service, *Research Paper PSW-146*. http://www.fs.fed.us/psw/publications/rice/Rice79.pdf

Road Construction Opposing View #46 - "Sediment eroded from gravel roads can be a major component of the sediment budget in streams in this region (Van Lear, et al, 1995)."

Riedel, Mark S. Ph.D. and James M. Vose Ph.D., **"Forest Road Erosion, Sediment Transport and Model Validation in the Southern Appalachians."** Presented at the Second Federal Interagency Hydrologic Modeling Conference, July 28 – August 1, 2002. http://www.srs.fs.usda.gov/pubs/ja/ja_riedel002.pdf

Road Construction Opposing View #47 - “Early studies of elk were among the first to address effects of roads on wildlife, establishing a precedent for subsequent research on a wide range of terrestrial and aquatic species. These early elk-roads studies included those reported in a symposium on the topic in 1975 (Hieb 1976), the seminal studies of Jack Lyon in Montana and northern Idaho (Lyon 1979, 1983, 1984), the Montana Cooperative Elk-Logging Study (Lyon et al. 1985), and work by Perry and Overly (1977) in Washington and Rost and Bailey (1979) in Colorado.

As research and analysis techniques have become more sophisticated, particularly with the advent of geographic information systems (GIS) and high-resolution remote imagery, the study of effects of roads on terrestrial and aquatic communities has evolved into a unique discipline of “road ecology” (Forman et al. 2003). Road effects are far more pervasive than originally believed and include such disparate consequences as population and habitat fragmentation, accelerated rates of soil erosion, and invasion of exotic plants along roadways. Indeed, “in public wildlands management, road systems are the largest human investment and the feature most damaging to the environment” (Gucinski et al. 2001:7). Summaries of the effects of roads on wildlife habitats and biological systems in general have been compiled by Forman and Alexander (1998), Trombulak and Frissell (2000), Gucinski et al. (2001), Forman et al. (2003) and Gaines et al. (2003).”

Rowland, M. M., M. J. Wisdom, B. K. Johnson, and M. A. Penninger 2005. “**Effects of Roads on Elk: Implications for Management in Forested Ecosystems**.” Pages 42-52 in Wisdom, M. J., technical editor, *The Starkey Project: a synthesis of long-term studies of elk and mule deer* Reprinted from the 2004 Transactions of the North American Wildlife and Natural Resources Conference, Alliance Communications Group. http://www.fs.fed.us/pnw/pubs/journals/pnw_2004_rowland001.pdf

Road Construction Opposing View #48 - "The consequences of road construction to wildlife are generally negative. Roads result in increased human access, habitat fragmentation, disturbance, and in some cases direct mortality due to vehicle collisions."

"Research has documented an 80% decline in grizzly bear habitat use within 1 km of open roads used by motorized vehicles in Montana[9]. This has been ascribed either to bears avoiding humans or to the selective over-harvest of bears habituated to humans that would otherwise more fully use areas heavily influenced by people."

Schwartz, Chuck Ph.D. - March 1998 "**Wildlife and Roads**"
The Interagency Forest Ecology Study Team (INFEST) newsletter
http://www.sf.adfg.state.ak.us/sarr/forestecology/fsroads.cfm

Road Construction Opposing View #49 - "The effects of forest roads on hydrology are related to the effects of forest clearing. Most logging requires road access, and the roads often remain after the logging, so there are both short and long-term effects.[94] Forest road surfaces are relatively impermeable. Water readily runs over the road surface and associated roadside ditches, often directly to a stream channel, with the net effect of extending channel networks and increasing drainage density.[95] In addition to providing conduits for overland flow, forest roads involve slope-cuts and ditching that may intersect the water table and interrupt natural subsurface water movement.[96] This diversion of subsurface water may be quantitatively more important than the overland flow of storm water in some watersheds.[97] The importance of roads in altering basin hydrology has

been underscored in paired-watershed studies and recent modeling studies.[98] " (Pgs. 730 and 731)

Shanley, James B. and BeverleyWemple Ph.D.
"**Water Quantity and Quality in the Mountain Environment**"
Vermont Law Review, Vol. 26:717, 2002
http://www.uvm.edu/~bwemple/pubs/shanley_wemple_law.pdf

Road Construction Opposing View #50 - "Roads are often the major source of soil erosion from forested lands (Patric 1976)."

"Generally, soil loss is greatest during and immediately after construction."

Swift Jr., L. W. **"Soil losses from roadbeds and cut and fill slopes in the Southern Appalachian Mountains."**
Southern Journal of Applied Forestry 8: 209-216. 1984.
http://cwt33.ecology.uga.edu/publications/403.pdf

Road Construction Opposing View #51 - "More subtle causes of habitat loss include the construction of roads and power lines. These linear barriers also have been correlated with a decline in neotropical migrant songbirds (Berkey 1993; Boren et al. 1999; Ortega and Capen 2002). Whether by forest conversion or the construction of roads and power lines, fragmentation subdivides habitat into smaller and smaller parcels. The result is an increase of edge habitat, or the boundary between intact forest and surrounding impacted areas. Small forests with large amounts of edge habitat are a hostile landscape for nesting neotropical migratory songbirds. In these areas, songbirds face two great threats: 1) the loss of eggs and nestlings to predators and, 2) parasitism by cowbirds."

Switalski, Adam "**Where Have All the Songbirds Gone?**
Roads, Fragmentation, and the Decline of Neotropical Migratory Songbirds"
Wildlands CPR, September 8, 2003
http://www.wildlandscpr.org/node/213

Road Construction Opposing View #52 - "Roads are a widespread and increasing feature of most landscapes. We reviewed the scientific literature on the ecological effects of roads and found support for the general conclusion that they are associated with negative effects on biotic integrity in both terrestrial and aquatic ecosystems. Roads of all kinds have seven general effects: mortality from road construction, mortality from collision with vehicles, modification of animal behavior, alteration of the physical environment, alteration of the chemical environment, spread of exotics, and increased use of areas by humans. Road construction kills sessile and slow-moving organisms, injures organisms adjacent to a road, and alters physical conditions beneath a road. Vehicle collisions affect the demography of many species, both vertebrates and invertebrates; mitigation measures to reduce roadkill have been only partly successful. Roads alter animal behavior by causing changes in home ranges, movement, reproductive success, escape response, and physiological state. Roads change soil density, temperature, soil water content, light levels, dust, surface waters, patterns of runoff, and sedimentation, as well as adding heavy metals (especially lead), salts, organic molecules, ozone, and nutrients to roadside environments. Roads promote the dispersal of exotic species by altering habitats, stressing native species, and providing movement corridors. Roads also promote increased hunting, fishing, passive harassment of animals, and landscape modifications. Not all species and ecosystems are equally affected by roads, but overall the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian systems. More experimental research is needed to complement post-hoc correlative studies. Our review underscores the importance to conservation of avoiding construction of new roads in

roadless or sparsely roaded areas and of removal or restoration of existing roads to benefit both terrestrial and aquatic biota."

Trombulak, Stephen C. Ph.D. and Christopher A. Frissell Ph.D. "**Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities**" Conservation Biology, Volume 14, No. 1, Pages 18–30, February 2000
http://www.transwildalliance.org/resources/200922144524.pdf

Road Construction Opposing View #53 - "Roads are a major contributor to habitat fragmentation because they divide large landscapes into smaller patches and convert interior habitat into edge habitat. As additional road construction and timber harvest activities increase habitat fragmentation across large areas, the populations of some species may become isolated, increasing the risk of local extirpations or extinctions (Noss and Cooperrider 1994)."

"Habitat fragmentation creates landscapes made of altered habitats or developed areas fundamentally different from those shaped by natural disturbances that species have adapted to over evolutionary time (Noss and Cooperrider 1994 *in* Meffe et al. 1997). Adverse effects of habitat fragmentation to both wildlife populations and species include:

"Increased isolation of populations or species, which leads to:

- Adverse genetic effects; i.e. inbreeding depression (depressed fertility and fecundity, increased natal mortality) and decreased genetic diversity from genetic drift and bottlenecks,

- Increased potential for extirpation of localized populations or extinction of narrowly distributed species from catastrophic events such as hurricanes, wildfires or disease outbreaks,

- Changes in habitat vegetative composition, often to weedy and invasive species,

- Changes in the type and quality of the food base,
- Changes in microclimates by altering temperature and moisture regimes,
- Changes in flows of energy and nutrients,
- Changes in the availability of cover and increases edge effect, bringing together species that might otherwise not interact, potentially increasing rates of predation, competition and nest parasitism, and
- Increased opportunities for exploitation by humans, such as poaching or illegal collection for the pet trade."

Watson, Mark L. **"Habitat Fragmentation and the Effects of Roads on Wildlife and Habitats."** *Background and Literature Review* 2005. http://www.wildlife.state.nm.us/conservation/habitat_handbook/documents/2004EffectsofRoadsonWil dlifeandHabitats.pdf

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Road Construction Opposing View #54 - "Our analysis also indicated that >70 percent of the 91 species are affected negatively by one or more factors associated with roads."

"Roads in forested areas increase trapping pressures for martens and fishers, resulting in significantly higher captures in roaded versus unroaded areas (Hodgman and others 1994) and in logged versus unlogged areas, in which the difference was again attributed to higher road densities in logged stands (Thompson 1994). Secondary roads also might increase the likelihood that snags and logs will be removed for fuel wood. This could impact fishers, martens and flammulated owls, and also could have a negative effect on the prey base for goshawks (Reynolds and others 1992)."

"An additional, indirect effect of roads is that road avoidance leads to underutilization of habitats that are otherwise high quality."

Wisdom, Michael J., Richard S. Holthausen Ph.D.
Barbara C. Wales Ph.D., Christina D. Hargis Ph.D.
Victoria A. Saab Ph.D., Danny C. Lee Ph.D.
Wendel J. Hann Ph.D. Terrell D. Rich, Mary M. Rowland,
Wally J. Murphy, and Michelle R. Eames
"Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-Scale Trends and Management Implications Volume 2 – Group Level Results." USDA Forest Service, *PNW-GTR-485*, May 2000.
http://maps.wildrockies.org/ecosystem_defense/Science_Documents/Wisdom_et_al_2000/Vol_2a.pdf

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Road Construction Opposing View #55 - "According to the DEIS, the Forest now manages a total of 5,914 miles of roads across the Forest. Scientific literature has established that roads have numerous widespread, pervasive and, if left untreated, long-lasting biological and physical impacts on aquatic ecosystems that continue long after completion of construction. (Angermeier et al. 2004). Roads increase surface water flow, alter runoff patterns, alter streamflow patterns and hydrology, and increase sedimentation and turbidity. Roads are the main source of sediment to water bodies from forestry operations in the United States. (US EPA 2002). Road construction can lead to slope failures, mass wasting and gully erosion. Road crossings can act as barriers to movement for fish and other aquatic organisms, disrupting migration and reducing population viability. (Schlosser and Angermeier 1995). Chemical pollutants that enter streams via runoff, such as salt and lead from road use and management, compound these impacts. Most of these adverse effects are persistent and will not recover or reverse without human intervention. The techniques for road remediation are well established, agreed upon and readily available. (Weaver et al. 2006)." (Pg. 2)

Wright, Bronwen, Policy Analyst and Attorney Pacific Rivers Council
Excerpt from a May 11, 2009 letter to the Rogue River-Siskiyou

National Forest Travel Management Team
http://www.pacificrivers.org/protection-defense/comment-letters/Rogue%20River%20Siskiyou%20TMP%20DEIS.pdf

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Road Construction Opposing View #56 - "Fires do not leave a large road network in place (assuming the blaze was not suppressed otherwise there may be dozer lines, etc.). Logging creates roads that fragment habitat and generally increase human access, both of which affect the use of the land by wildlife. Moreover, roads and logging equipment can become vectors for the dispersal of weeds."

Wuerthner, George 2008 "**Ecological Differences between Logging and Wildfire**"
http://wuerthner.blogspot.com/2008/12/ecological-differences-between-logging.html

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Road Construction Opposing View #57 - "Forest fragmentation occurs when large, contiguous blocks of forest are broken up into isolated islands by development, roads, or clearing for agriculture. Just as inbreeding among the royal families of Europe spread hemophilia, forest fragmentation negatively impacts the long term sustainability of both plant and animal communities. Geographic isolation results in inbreeding and diminishes biodiversity."

Zimmerman, E.A. and P.F. Wilbur "**A Forest Divided**"
New Roxbury Land Trust newsletter, 2004
http://www.ourbetternature.org/forestfrag.htm